LIQUID CRYSTAL DISPLAY DEVICE WITH A FLEXIBLE LIQUID CRYSTAL CELL THAT IS FOLDED

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is related to a portable electronic apparatus, such as a notebook computer or hand-held meter, having as its display a liquid crystal display (LCD) panel, more particularly, a flexible one which allows the overall size of the portable electronic apparatus to be reduced in a carrying mode.

2. Description of the Prior Art

LCD devices are widely used as a display portion in a variety of portable electronic apparatus because they are not only thin and light but have an advantage of low electrical power consumption.

Despite a need to make a portable device as small as possible the conventional LCDs succeeded only in reducing the thickness of it. But reduction in its planar dimensions was limited because the display is preferred to be as large as possible for easy readability. In other words there is a conflicting demand to reduce the overall volume of the portable device and yet to make its display portion large.

In an attempt to overcome this drawback, an LCD having multiple sections which are connected to each other with joints and thus foldable was proposed. But it has its own disadvantages of deteriorated display quality at those joints.

SUMMARY OF THE INVENTION

Therefore, the present invention has been made in an effort to solve the above described problems.

It is an objective of the present invention to provide a flexible liquid crystal display (LCD) device which is flexible without the use of a joint, thereby reducing a portable size of an electronic apparatus when applied to the same while providing an enlarged display screen size without deteriorating display quality.

It is another objective of the present invention to provide an electronic apparatus with a flexible LCD device which can reduce a portable size of the apparatus while increasing a display screen size.

To achieve the above objectives, the present invention provides an LCD device flexible in at least one portion. The LCD device comprises a liquid crystal cell, a reinforcement plate disposed on an outer surface of the liquid crystal cell, and at least two strip shaped recesses formed by removing portions of the reinforcement plate in the flexible portion, whereby the LCD device is flexed without any joint.

The LCD device may further comprise a flexible film attached on the reinforcement plate, a circuit board coupled to the liquid crystal cell, a driver coupled to the circuit board via a tab integrated circuit, and a flexible printed circuit for connecting the liquid crystal cell to the circuit board.

According to another aspect of the present invention, an electronic apparatus has a structure for coupling the above described LCD device.

That is, the electronic apparatus comprises an LCD device having at least one flexible portion, a main body having front, rear, right and left sides, and a coupling member for coupling the LCD device to the main body.

The LCD device can have a screen size more than twice the total upper surface of the main body, and thus completely wrap the upper surface, the front side, and the bottom surface of the main body. The front side of the main body is rounded to allow the LCD device to bend without a sharp 90° angle, which would be stressful to the bent portion.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate an embodiment of the invention, and, together with the description, serve to explain the principles of the invention:

FIG. **1** is a perspective view illustrating an electronic apparatus with a flexible LCD device according to a preferred embodiment of the present invention;

FIG. **2** is a sectional view taken along line A—A of FIG. **1**;

FIG. **3** is a plane view illustrating a module portion of an liquid crystal cell according to a preferred embodiment of the present invention;

FIG. **4** is a sectional view illustrating a curved portion of a flexible LCD device according to a preferred embodiment of the present invention; and

FIGS. **5***a* to **5***d* are perspective views illustrating operation modes of a flexible LCD device to an electronic apparatus.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The preferred embodiment of the invention will be described referring to the accompanying drawings. Wherever possible the same reference numbers will be used throughout the drawings to refer to the same or like parts.

Referring first to FIG. **1**, there is shown an electronic apparatus with a flexible liquid crystal display (LCD) device according to a preferred embodiment of the present invention.

The electronic apparatus according to a preferred embodiment of the present invention comprises a main body **2** and an LCD device **8**.

The main body **2** of the portable computer has a rounded front side, and the LCD device **8**, optionally provided with a touch panel portion **6**, pivotally coupled to the main body **2** at the rear periphery of the upper surface. A keyboard is formed on the upper surface of the main body **2**.

Describing more in detail, guides **12** are formed along left and right peripheries of the main body **2** such that they are raised from the upper surface of the main body **2**. The rear ends of the guides **12** have pivot holes **14'** into which pivot shafts **14** extending from the lower corners of the LCD device **8** are inserted. The guides **12** are further provided along their length with guide slots **10** from the pivot holes **14'** to the rounded front side such that the pivot shafts **14**, inserted into the pivot holes **14'**, can slidably move along in the guide slots **10**.

Frames **16** are formed along right and left sides of the LCD device **8** such that they are aligned with the guides **12**. Accordingly, the frames **16** can be stably disposed within the guides **12** when the LCD device is slidably inserted into the guides **12**, thereby preventing the LCD device **8** from deforming.

Particularly, to electrically connect the LCD device **8** to a processor disposed inside the main body **2**, as shown in FIG. **2**, a slit **18** is formed on the upper surface of the main body